BLOCKMEDX

Blockmedx
Whitepaper v1.0

Contents

Preface from the CEO

Dear Community,

Thank you for taking your time to learn about our project and your interest in BlockMedx. It's been over a year now since I began developing the idea for the BlockMedx application. In my years of practice as a pharmacist, I couldn't help but notice many of the security and identity issues inherent in the current prescription system.

The identities of prescribers or patients are often not well defined, and prescriptions written on paper lack security and transparency by nature. Poor security and potential prescription fraud were frequent observations in my practice. I knew that fixing the security holes in the system and building a better network to monitor patients for early detection would require something new--built from the ground up. We are designing an application that we hope will improve the security, safety, and health outcomes of our patients.

The opioid crisis is where we believe we can have the most impact in the first deployment of our e-prescribing application. Blockchain technology and its associated identity solutions offers a unique opportunity to solve many of these problems in an innovative way.

BlockMedx is the culmination of our experiences working in healthcare and is based on our firm belief that healthcare can be transparent, secure, and personal. As a team of healthcare providers focused on patient care, we are uniquely qualified to develop an application focused on patient health and safety, and hope that you may share our vision and join us on our journey.

Sincerely,

Michael J Brunner, PharmD
BlockMedx CEO and Founder

Abstract

On August 10, 2017 the opioid epidemic was declared a national public health emergency in the United States. While the problem has multiple causes, one of the primary issues contributing to this public health crisis is the use of an antiquated system of prescribing controlled medications. This leads to prescriptions that can be easily altered, as well as difficulty monitoring patients and prescribers.

BlockMedx intends to provide a novel e-prescription platform that will provide secure transmission of prescriptions, a complete universal history of prescriptions for patients, pharmacists, and providers, and incentives to reduce overprescribing and prescription fraud.

Specifically, we aim to overcome problems with identity verification of stakeholders, prescription alterations and forgeries, and inadequate prescription transparency.

BlockMedx intends to achieve these goals by creating a decentralized application using the Ethereum blockchain. BlockMedx intends to use novel identity verification methods to verify prescription information, and to create a real-time, complete record of prescriptions analysed by machine-learning algorithms.

1. Background:
The Prescription Drug Abuse Epidemic

Prescription drug abuse, specifically of opioids, is one of the most significant public health crises of the 21st century. Two million adults over the age of twelve have a substance abuse problem involving prescription pain relievers. The American Society of Addiction Medicine reports that drug overdose is the leading cause of accidental death in the United States, with almost half of those fatalities coming from prescription opioid abuse.

Leading projections indicate that up to half a million Americans could die from prescription opioid overdoses within the next 10 years. This death toll rivals the projected fatalities from breast cancer and prostate cancer combined. This crisis is similar to the AIDS epidemic of the 1980's in death toll and scope. Drug overdose fatalities in the United States in 2016 exceeded the deadliest car collision death toll year on record. The time has come to put in place systems that will allow us to solve this enormous problem. BlockMedx intends to solve systemic problems in the prescription industry which are partly responsible for this catastrophe.

In an attempt to curb this growing public health crisis, the CDC has recently issued new opioid prescribing guidelines. Unfortunately, these guidelines are not actively enforced and merely exist as suggestions for proper prescribing practices.

The rampant overprescribing of opioid pain medications, prescription fraud, and a system of documentation and prescription generation which fundamentally relies on trust between the patients, prescribers, and pharmacies are just a few of the contributing factors that have led to this epidemic.

Most often, opioid prescriptions are handwritten on paper and can be altered, outright forged, or duplicated.

Pharmacists are forced to trust that the doctor is the one who physically wrote and signed the paper prescription often based on nothing more than professional judgment. Issues in interpreting handwritten prescriptions also cause medication errors and may result in prescriptions being filled improperly or incorrectly.

Additionally, physicians are often unaware if the patient has received prescriptions from another doctor for similar medication, potentially doubling the patient's supply of medication, or creating harmful drug interactions. The current system for prescribing controlled substances lacks transparency and is in many instances untraceable. Available data is unreliable and incomplete.

Responsible doctors and pharmacists often have no way of knowing whether they're providing drugs to a legitimate user, or someone with illegal intentions. Traditional arrangements relying on trust and goodwill have become broken over time. Laws, regulations, and professional guidelines have all failed to solve the problem.

In light of this, BlockMedx intends to develop an application to make opioid prescriptions secure, to make sure medication gets to those who need it, and to make a broken system accountable. BlockMedx intends to be the first company to bring blockchain technology to the prescription drug industry.

2. Proposed Solution

2.1. Application

BlockMedx intends to change the way opioids are prescribed and supplied by creating a secure and effective system for providers to prescribe, pharmacists to fill, and patients to manage their prescriptions. Using the Ethereum blockchain, BlockMedx intends to be a secure, HIPAA and regulatory compliant, end-to-end e-prescribing platform for transmitting, analyzing, and managing prescriptions.

Prescriptions will be securely transmitted and recorded on the blockchain. A token will be paired to each specific prescription, securely verifying the prescription origin from the point of creation by the physician.

Physicians, pharmacists, and patients will login to the BlockMedx application, accessible from the BlockMedx website, using their blockchain based sovereign identity authentication. This website will have access to the Ethereum blockchain via a Web 3.0 interface. Physicians, pharmacies, patients, and other healthcare stakeholders such as payors will have an Ethereum address generated for them when on-boarding the system. This will be necessary for them to interact with the smart contracts and hold and utilize MDX tokens.

A crypto-based token will be required to issue prescriptions and issue payment incentives in the BlockMedx system. The website will provide healthcare stakeholders with their MDX balance and allow them to transfer their tokens; similar to existing token wallets.

The platform will initially be optimized for processing the most tightly controlled C-II prescriptions, however we intend for further functionality to be built in the future. The goal will be to create a system which can process every class of prescription, provide patient incentives, and allow patients to regain control of their own prescription data.

BlockMedx also intends to be integrated in the future with pharmaceutical supply chain solutions in order to track prescription drugs to the actual patient. Current pharmaceutical supply chain solutions end their analysis at the wholesaler or pharmacy. BlockMedx could potentially bridge the gap from manufacturer to patient.

As technology progresses and further Ethereum protocol improvements are made, BlockMedx intends to evolve into a full-service prescription platform, encompassing many different uses and focused on providing optimal patient care and improving health outcomes.

2.1.1. For Physicians

Physicians will have the ability to view their own prescribing history and the entire prescription history of the patients that they are approved to view. Physicians will access the BlockMedx decentralized application (D-App) in their office to generate a new prescription.
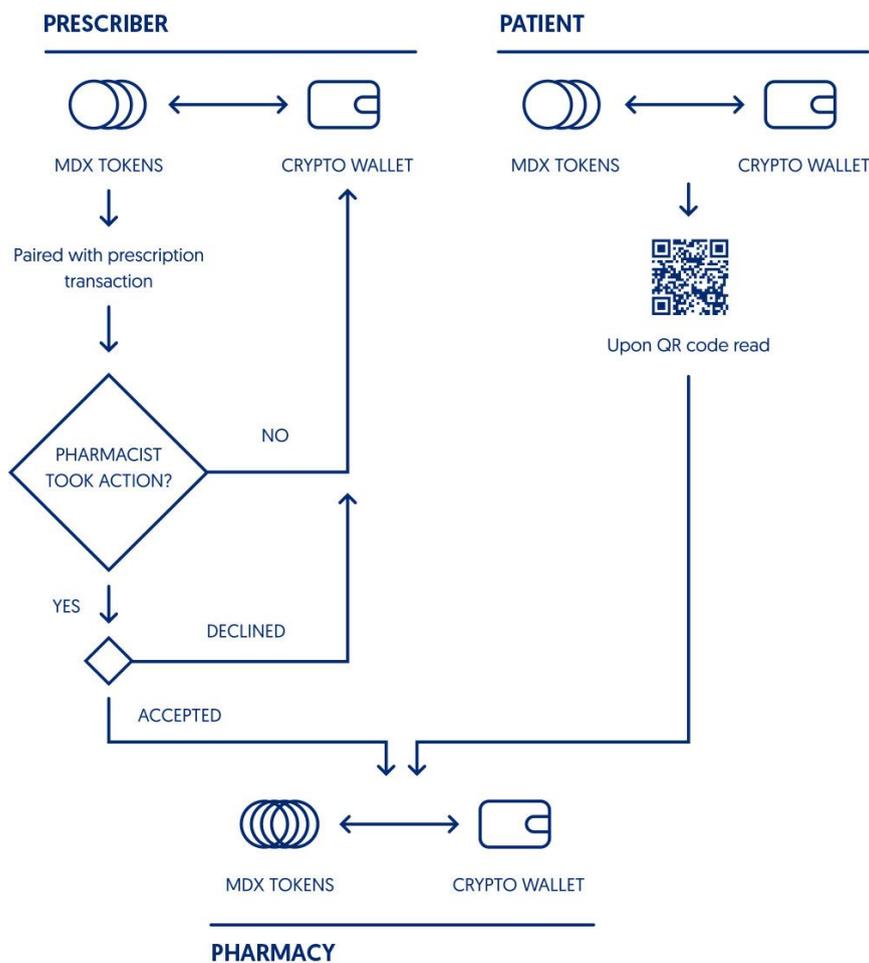
Physicians will have the ability to issue new prescriptions by filling out the necessary auto-populated fields on an electronic form. The physician will sign the prescription using a blockchain-based identity verification method which will be paired to their private key on the network.

The verification method BlockMedx intends to use will ensure that only the actual physician can sign and transmit prescriptions. This ensures total identity integrity for that physician's prescribing authority. Next, they must specify the pharmacy that is to receive the prescription. The patient may also elect to retain control over the destination of the prescription, and authorize the prescription to a pharmacy of their choice once they arrive.

BlockMedx intends for the physician's user interface to be a superior user experience compared to other existing e-prescribing solutions. Having a superior UI/UX to other e-prescribing platforms, which tend to be difficult to use, will help drive adoption.

To issue a new prescription the physician must pay a fee in BlockMedx tokens, which is likely to cost significantly less than their current prescription payment method. Physicians will need to obtain tokens to facilitate the secure transmission of their prescriptions using the BlockMedx system.

The prescription will be digitally signed by the BlockMedx platform for the physician; similar to hosted token wallets. By signing the prescription, BlockMedx will verify that the prescription is valid and that the physician has valid and active prescribing credentials.

When a prescription is issued by a physician, it is in a "pending" state, waiting for signature by BlockMedx. Once BlockMedx digitally signs the prescription on the Ethereum blockchain, it is sent into an "approved" state. The prescription is then committed to the Ethereum blockchain.

Physicians will be able to view a list of their prescription history which will include the prescription's current status: pending, approved, revoked, declined, or accepted. Physicians will also see if the patient attempted to use his/her prescription at more than one pharmacy.

If a prescription is in a pending or approved state, the physician may revoke it which would cause it to enter a revoked state. If a prescription is revoked, or if it is declined by the pharmacy, the token balance will be returned to the physician or hospital admin as tokens available to be issued.

Tokens used by physicians are only for transmitting prescriptions. Only pharmacies, value based healthcare systems, and payors can move tokens freely, in order to utilize the incentive based token economy.

2.1.2. For Pharmacies

Pharmacies will be presented with a queue of approved prescriptions. The receiving pharmacist will open the BlockMedx App from any one of their computers to access the network. For each prescription, the pharmacy will be given the prescription information, and the ability to view a comprehensive list of the patient's prescription history. They will have the option to accept or decline each prescription that is present in their queue.

Upon acceptance, the pharmacy will be provided with the tokens issued by the physician. The token will be deposited in the pharmacy's integrated token wallet. A pharmacy employee will sign a confirmation of the receipt for the prescription using a blockchain based identity solution. They will then be able to print the prescription.

This printed prescription will include a QR code which can be used to validate the prescription, or they will receive the equivalent QR code from the patient, as retained in the patient's mobile app. The QR code will correspond to a transaction ID denoting the fact that the prescription has been transmitted to a pharmacy, filled by that pharmacy, and is no longer valid. The transmission of the prescription will essentially constitute a micro-transaction of tokens from the physician to the pharmacy.

Pharmacies will be able to accept token payments from patients for their prescription co-pays or for other goods and services, through the BlockMedx application as well. Credit card fees are steep for small co-pay transactions, therefore small token payments from the patients to the pharmacies present another unique opportunity for cost-saving to pharmacies.

Pharmacies will also be able to see a history of prior payments from the individual patient as well as request payments from the patient through their mobile application.

The pharmacy will be able to move their tokens freely in and out of their token wallet.

2.1.3. For Patients

Patients will be able to see their prescription history after login to the mobile or Web 3.0 application. They (or anyone else with credentialed access to the system) can also scan the QR code on their retained prescription (if one was given) to verify that the prescription has been filled by a particular pharmacy.

Patients will receive alerts when a new prescription is created and transmitted for them by a physician, when a prescription is accepted and filled by a pharmacy, and also when they may be eligible for a refill of their prescription. Patient engagement incentives are possible within the BlockMedx application for medication adherence, healthy behavior adoption, and patient education.

Patients will be able to communicate with their physician and pharmacist, receive updates and new information about their prescription regimen, and participate in engagement surveys.

Patients will also be able to hold MDX tokens on their mobile device just like any other token wallet. MDX tokens may be used by patients to pay their co-pay or for other goods or services at the pharmacy or physician's office. Patients may also receive MDX token incentives for healthy behavior from their insurance provider.

To facilitate medication adherence, an incentive structure can be set up whereby a patient is paid in MDX tokens each time they refill their prescription on time, visit their doctor, or receive patient education in the application. The MDX tokens provide a token based incentive economy for patients to pay for their prescriptions at the point of sale and receive new incentives for healthy behavior.

2.1.4. For Auditors

Auditors can be any type of third party entity, be that private or government, which legally are required to audit any such prescription transactions as would be contained in the BlockMedx system. Examples could include the DEA or the healthcare organizations to which the physician belongs.

Prescription records on the BlockMedx dApp will be auditable by boards of pharmacy, the pharmacies themselves, and the physicians. The physicians will be able to access an immutable record of the prescriptions they have written and sent using the platform, and the pharmacies will be able to access an immutable record of prescriptions they have received using the platform.

Auditors are able to request from the BlockMedx platform identity and prescription verification. They can also access the complete prescription history associated with a patient, physician, or pharmacy on the BlockMedx platform. Boards of Pharmacy and the DEA will have immediately auditable records of prescribing practices for each physician.

Additionally, predictive analytics will be utilized to generate alerts of suspicious activity that will then be reported to the relevant overseeing bodies. Privately, patients can elect with whom to share their individual prescription data in a secure manner. Patients can share or revoke access to their prescription records to pharmaceutical companies, researchers, healthcare organizations or insurance providers that may not have a legal obligation to those records already, and receive MDX token incentives for providing this valuable data to these private parties.

2.2. The Benefit of using Blockchain

Blockchain technology allows for security, trustless verification, and immutability that revolutionizes the current processes for the transmission of prescriptions. Despite advances with current technology, the industry is fraught with security breaks that have exposed personal and private health information in widely publicized ransomware attacks. At the most basic level, paper prescriptions lend themselves to medication errors[1] in up to 40% of cases, and they are also easily forged and duplicated.

Next, standard e-prescription platforms have been hacked in the past, which allowed for false prescription transmission but also forced doctors to adopt paper prescriptions as a temporary measure. Even simple DDOS attacks have rendered current e-prescribing solutions inoperable for periods of time - as well as putting highly sensitive patient data at risk. Blockchain technology affords the security and operability needed to keep personal information private, and prevent fraud in the healthcare system.

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[1] Kaushal, Rainu, et al. "Electronic prescribing improves medication safety in community-based office practices." *Journal of general internal medicine* 25.6 (2010): 530-536.

Another benefit of blockchain technology is trustless verification. Sovereign identity in healthcare is not available today. That means that when a pharmacist accepts a prescription from a patient, they have no way of knowing if it is a fraudulent or duplicate prescription, who actually prescribed it, or where the prescription actually came from. The current process requires the pharmacist to contact the prescriber and verify the prescription if they have doubts based on their own professional judgment. With blockchain technology, all key stakeholders are verified removing trust from the system and allowing significant efficiency gains.

Immutability is a fundamental aspect of blockchain technology, and one that shows tremendous promise for the healthcare landscape. With an immutable prescription ledger, patients won't be able to doctor shop and obtain multiple duplicate prescriptions. Similarly, false prescription claims aimed to defraud healthcare payors will cease to be an ongoing concern. Prescription claims can be verified against the immutable prescription ledger, removing the possibility of fraudulent or duplicate claims being submitted.

Additionally, an immutable ledger allows for interoperability among healthcare systems and finally gives patients ownership over their data. This data can be accessed, with the right permissions, to stimulate scientific research, automate health analytics, and precipitate a new incentive structure aimed to make patients healthier and care more affordable.

3. Technical Explanation

3.1. BlockMedx Application

- **Front end UI built with different stakeholders in mind.**
  UI/UX is a primary focus for BlockMedx. Physicians, pharmacies, and patients may login to a web or mobile UI of the dApp using a username and password or by utilizing a blockchain sovereign identity solution. This UI will allow users to interactively query and submit prescriptions to the blockchain.

  Physicians and pharmacies will have an address generated for them when on-boarding the system. This will be necessary for them to interact with the smart contracts and hold tokens. The UI will provide hospitals and pharmacies with their token balance and allow them to transfer their tokens; similar to existing cryptocurrency wallets.

- **Secure prescription ledgers on the blockchain**
  BlockMedx intends to use Quorum as its private distributed ledger to record the immutable prescription transactions and host smart contracts. Quorum is an enterprise-focused version of Ethereum and supports both transaction level privacy and network wide transparency. Upon further Ethereum protocol upgrades, we intend to move to the public Ethereum chain once we are satisfied with respect to associated privacy and security concerns that are currently present.

  BlockMedx is also developing a secure decentralized prescription storage service built on top of a private IPFS network. IPFS is a peer-to-peer protocol and distributed network to store and share information faster, more safely and more transparently. We are setting up private and permissioned IPFS nodes in our secure cloud and use them to store the encrypted patient prescription information and sensitive data. Privacy and security of patient data and information is of utmost importance, therefore we are creating a system with those considerations in mind.

  By combining the Quorum network and secure IPFS storage, BlockMedx can provide high speed and high throughput processing of secure transactions within a permissioned group of known participants in a secure and manner while avoiding issues with single points of failure.

- **Smart contract layer**

  The token economy through the use of MDX tokens allows for a new incentive structure that aligns the patient with the healthcare system. BlockMedx smart contracts handle the secure transfer of prescription from provider to patient and pharmacy. Hashed prescription information has no central authority that holds key information. This means only the patient owns their prescription and only they have access to fill it. BlockMedx provides trustless verification and allows the regulatory bodies to audit and report the patient prescriptions that are non forgeable or duplicable.

- **BlockMedx Server with high availability and failover safe**

  We use Microsoft Azure to host a BlockMedx server to query and index the prescriptions, interact with third party drug API or data, and send out real time notifications. BlockMedx also intends to build a high performance data warehouse that powers data analytics and insights, and runs machine learning algorithms for patient outcome monitoring and prediction.

  As blockchain protocol upgrades are made with respect to scalability, security, and privacy, we intend to move our tech stack onto secure public networks once they become available. Our goal is to be cautious and diligent with respect to the protection of patient data and patient privacy, therefore we need to make sure any public networks we utilize are of the utmost integrity. To begin, we are building the application as described above, but along our journey, and as the blockchain industry evolves and matures, we will continuously be making upgrades and improvements.

Data flow diagram:
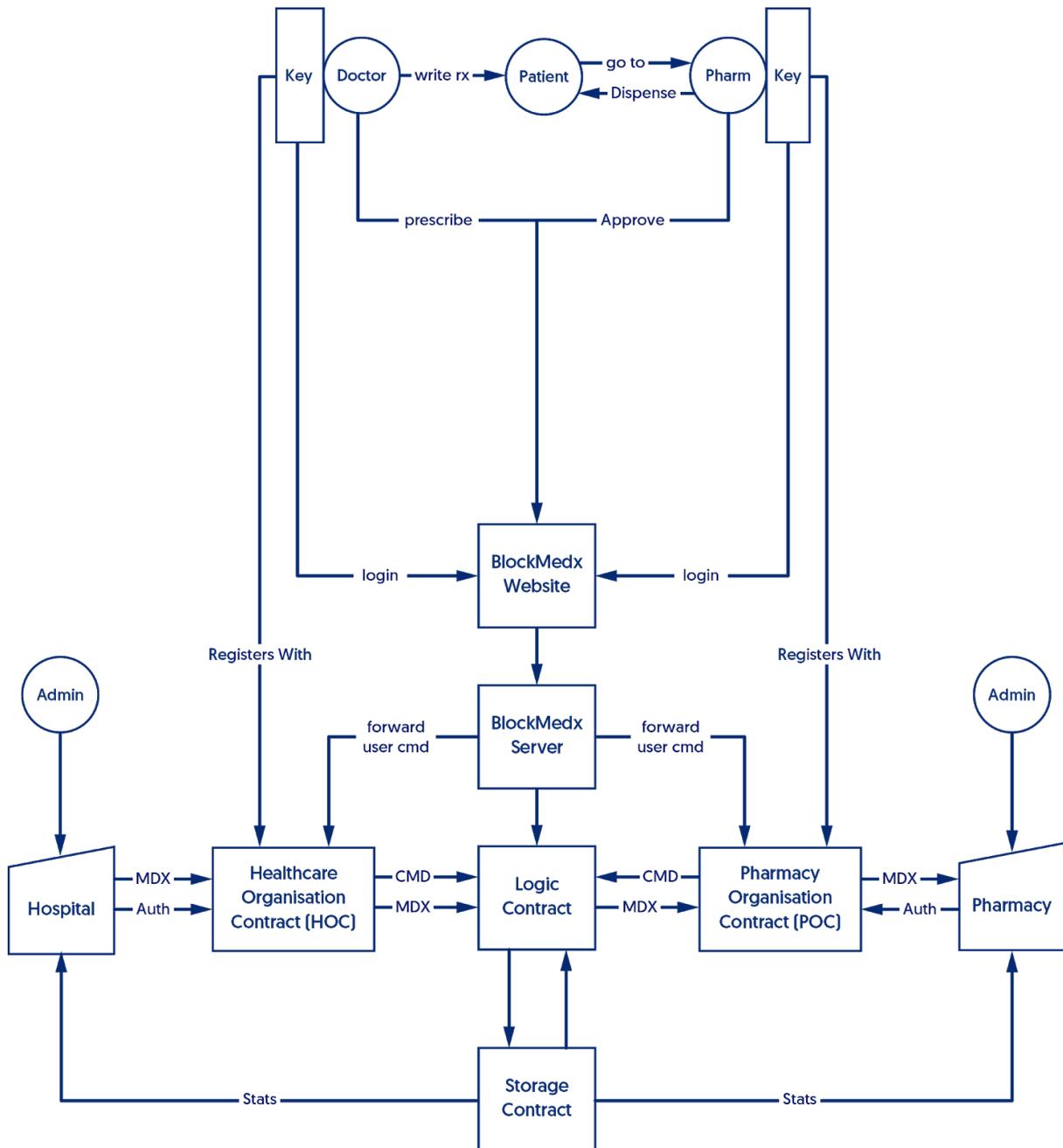
4. Market Analysis

4.1. Current Solutions

The medical community is focused on treatment because that is how the incentive system is currently set up. The majority of federal funds distributed to states are being used for treatment such as increasing the supply of naloxone and increasing the volume of methadone clinics and Medication Assisted Treatment programs.

Pharmaceutical companies are taking a more active role in healthcare and tackling the problem with longer-acting and potentially less addictive pain medication. Treatment is important for the disease of addiction, and treatment can last a lifetime for some patients. This makes it a bottomless pit of resource allocation. What about the patients who are earlier in their patient journey? How can we prevent the problem from occurring in the first place? How can we identify and reach patients earlier in their addiction journey to provide effective interventions?

Prevention currently is in the form of PDMPs or state sponsored prescription database monitoring programs. They receive less than 5% of funds allocated for the opioid crisis, require only the pharmacist to input prescription transaction data, and are state siloed with data that is not in real-time. While they have been shown to reduce opioid deaths by reducing in-state doctor shopping (Florida has seen an 18% drop after implementation), on average <6% of providers query the database in most areas. An incentive structure is just not codified, and the data available is incomplete and of poor quality.

4.2. Environmental Potential

The patient journey starts with something as simple as a visit to your doctor for back pain or to your dentist for toothache. Opioids are prescribed for breakthrough pain but are misused. Patients' pain threshold is low, and they ask for more opioid pills. When the provider refuses to prescribe any more pills, the patient is faced with clear options: 1. Try another in-state or out-of-state provider, 2. Forge a prescription, or 3. Purchase legal prescription pills from others who have doctor shopped or forged prescriptions.

At some point, the high from oral prescriptions through the digestive system just takes too long to take effect, and some patients begin crushing their pills, melting them in a metal spoon, and injecting the liquid directly into their veins. At this stage, the sources of legal prescription pills are not large enough for some and patients turn to illicit drugs.

Drug traffickers from Mexico have capitalized on America's opioid addiction, and have increasingly laced heroin with fentanyl, a powerful opioid drug. Deaths due to legal prescription drugs continue to rise, and consequently deaths due to heroin and other illicit drugs are also rising. Up to 90% of heroin users started with prescription opioids. If we can help to solve the prescription opioid problem, we can potentially help to prevent patients from moving on to illegal drugs.

5. Token Utilities

5.1. MDX Token

The native token for use on the BlockMedx network will be the MDX token. The token will use the ERC-20 token standard.

The MDX tokens can be purchased by patients, providers, larger healthcare organizations, or payors (health insurance or value based organizations) or others who have use for the token. The tokens may be used for payment of co-pays, or for patient incentive mechanisms adopted by healthcare organizations or payors.

Organizations who employ physicians - or in the case of independent physicians the physicians themselves - will be required to pay a small monthly subscription fee to BlockMedx in order to gain credentialed access to the BlockMedx network. If a healthcare organization fails to pay their monthly subscription fee, their access to the BlockMedx network will be revoked.

For each prescription a pharmacy receives, the corresponding amount of tokens attached to that prescription will be deposited in the pharmacy's integrated wallet. The transmission of a prescription from a physician to a pharmacy will constitute a micro-transaction of BlockMedx tokens from the physician's wallet to the pharmacy's wallet.

Pharmacies may also receive MDX tokens from patients in the form of payments for goods and services received at the pharmacy. Instead of paying at the register for their prescriptions or other goods with cash or credit card, patients may use MDX tokens that have been stored in their BlockMedx application's integrated wallet. The pharmacy may then do with its MDX tokens as it pleases. Pharmacies will be able to move MDX tokens freely in and out of their wallet as they please.

5.2. Benefits and Incentives

5.2.1. For Pharmacies

The BlockMedx system constitutes a completely new revenue stream for pharmacies, in that it is the first model of direct payments from physicians to pharmacies. Before BlockMedx, the only source of revenue for pharmacies was reimbursements from Pharmacy Benefit Management (PBM) companies, insurance companies, or co-payments from patients at the point of sale.

Often, pharmacies must wait months for reimbursement from these entities, in addition to having extremely slim, or non-existent margins on their sale of drugs. BlockMedx will be a brand new way for pharmacies to be paid for filling prescriptions. Additionally, BlockMedx will be a new, virtually fee-less payment channel that pharmacies may utilize to accept payments for goods and services from their patients.

Pharmacies will adopt the BlockMedx network because pharmacies are naturally incentivized to accommodate any system that drives prescriptions to them since that is their primary business model.

BlockMedx may provide a brand new revenue stream that may revitalize the pharmacy industry. E-prescribing of DEA Controlled Drug prescriptions on the BlockMedx network will also save pharmacists a great deal of time and energy that was previously spent on verifying the authenticity of paper prescriptions. The authenticity and source of prescriptions will no longer be in question.

5.2.2. For Physicians

Physicians will adopt the BlockMedx network because they will be receiving an EPCS compliant E-prescribing platform for a lower cost than legacy software solutions. Seven states in the United States have mandated E-prescribing of controlled substances in some way, and further state and federal legislation is pending. The market is moving towards secure e-prescribing of controlled drugs, and BlockMedx is providing a lower cost software solution to allow users to be compliant with forthcoming regulations. We are poised to be at the forefront of this wave of adoption.

Additional value-adds include the fact that physicians will have access to a complete, immutable record of prescriptions for their patients (even prescriptions written outside their healthcare system), allowing them to have complete knowledge of the patient's prescription history to better inform their prescribing practices.

BlockMedx intends to represent a significant cost savings to healthcare organizations as well. By potentially preventing costly drug overdose ER visits and hospitalizations through implementation of safer and more secure opioid prescribing practices and predictive analytics, a significant loss-leader can be potentially reduced by organizations that adopt the BlockMedx prescribing platform.

5.2.3. For Payors

Direct costs of the opioid epidemic are borne by payors or health insurance companies. BlockMedx offers potentially significant cost savings to payors through use of the advanced analytics layer that builds patient profiles, tracks drug transactions, and predicts abuse, fraud, and patient risk.

These analytics provide the nidus for early intervention to stem downstream costs from complications related to poor drug monitoring. In addition to the significant cost savings for payors, the BlockMedx platform provides a new way to structure incentive programs for patients.

The MDX token can be purchased and used to build programs related to Medication adherence (a $300 billion annual cost to payors), chronic disease management, care coordination, and a number of potential use cases where an incentive program can be used to improve patient health and reduce costs related to poorly managed illnesses.

5.3. Network Effect

We believe that this software service network will have a very strong effect between physicians, patients, healthcare organizations, and pharmacies. The healthcare organizations will essentially mandate that physicians use software that is compatible with the BlockMedx prescription protocol because of the powerful information that BlockMedx intends to obtain and curate.

Since BlockMedx intends to be the first to offer such software, it will quickly become the standard. This means that by getting a few very large healthcare organizations on board we can expect an exponential number of pharmacies on board as well. For marketing and business development purposes, the biggest return on investment will be from non-scalable marketing towards healthcare organizations. These will be door to door sales and presentations.

Pharmacies won't require individual sales. They will follow suit after their local healthcare organizations and prescribers have signed on. Net present value of the business will reflect a multiple of the predicted monthly revenue from subscriptions and transaction fees.

5.4. Security

In order for a transmission to be generated on the network, the transaction containing the prescription hash must be paired with the predetermined amount of token to be accepted by the network and transmitted. This adds an extra layer of security to transactions sent on the network, since prescriptions can only be sent from approved and verified addresses and wallets.

Patients will be able to securely access their own prescription records via a mobile application on their Android or iPhone. The patient's identity will be verified using a combination of Social Security Number, name, and birthdate during the process of setting up their personal account. After account verification, they will access the application using a username and password or sovereign blockchain identity solution.

5.5. Future Potential

The software that BlockMedx is building has the potential to change the way many processes in the prescription cycle are undertaken. Our most pressing need is to have a powerful social impact by stemming the tide of the opioid crisis. To do this we intend to build a new network among the key stakeholders in healthcare including physicians, pharmacies, patients, and payors. This network has significant intrinsic value as it allows for the potential of a new type of healthcare where patients are in the center; a so-called patient-centric network. We imagine the potential for patient engagement, physician care coordination, and more active role for payors in patient health to be a positive way to move forward for the healthcare system in the future.

Another benefit of the network is the accumulation of distributed data on the blockchain. This data can feed into medication adherence programs (a $300 billion annual cost in the US alone), fuel scientific research, as well as inform the pharmaceutical supply chain in its fight against counterfeit drugs (a $200 billion annual cost).

We see these and many more potential use cases for the BlockMedx network and are excited for the opportunity to have a long lasting impact in healthcare.

Lastly, while our efforts in the first three years are focused on developed nations, we intend to provide an affordable low cost e-prescribing solution powered by blockchain technology to developing countries, many of whom cannot afford the expensive IT infrastructure required with legacy e-prescribing systems.

While the e-prescribing network powers some of our analytics, building incentive programs onto the platform is not dependent on establishing adoption of the e-prescribing software and will be open internationally.

6. Business Model

The BlockMedx platform intends to be a user-friendly experience that connects physicians, pharmacies, payors, and patients. All of these parties will be able to access the BlockMedx protocol and smart contracts on the blockchain. The current state of healthcare software is dismal, with significant UI/UX problems in almost every application. BlockMedx intends to deliver a superior user experience for all stakeholders, coupled with innovative technology and information access to all parties involved.

The platform is free to use for patients and pharmacies, and initially free to use for physicians in order to drive adoption. For pilot projects, hospitals and physicians will be provided tokens free of charge. The revenue model is constructed from transaction and subscription fees paid by physicians (or their parent organizations). We intend to offer this at a significantly lower cost compared to existing legacy systems.

7. Roadmap

7.1. Status Quo

BlockMedx has had strong support from the crypto community and healthcare stakeholders. We have been accepted into MassChallenge, a very competitive accelerator with a tremendous impact of $2 Billion follow-on funding, and 65,000 jobs created. The accelerator supports startups with key partnerships[2], initial clients, as well as mentorship from its extended network of advisors and startup alumni. The four-month accelerator has an international network and partnerships in the US, Mexico, Israel, United Kingdom, and Switzerland.

In a market where there are more job openings for every software engineer, even more for engineers with blockchain experience, we are fortunate to have received tremendous interest in joining our team. With continued funding, we expect to continue to expand our team which currently consists of brilliant and dedicated software engineers and data scientists guided by a team of expert advisors.

We are on schedule to complete our MVP by the end of April and we are pushing full speed ahead with our development cycle in preparation for pilot studies later this year. We have had many conversations for potential partnerships with fortune 500 companies and smaller blockchain startups on potential use cases to develop on top of the BlockMedx network. We will continue to have these conversations and build relationships over the next several months. With development moving quickly, we are focusing on growing our team with sales, marketing, and operations experts and securing key partnerships to build the network.

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[2] http://boston.masschallenge.org/partners

7.2. Timeline

Q1 2018	Completion of MVP
	BlockMedx network goes live
Q2 2018	Token Pre-Sale
	MassChallenge Accelerator start
Q3 2018	Public token sale
	Intensive outreach to strategic partners
Q4 2018	Pilot projects online. Targeted areas will include Texas, Kentucky, Ohio, and West Virginia.
	Release of version 2.0 with application upgrades as scaling protocol advances
Q1 2019	Intensify implementations with healthcare systems
	Rapid scaling into additional states with the highest opioid death rates
	EMR (Electronic Health Record) and Telehealth platform API Access and Integration
	Key partnerships with addiction treatment organizations for patient education, communication, and early intervention
Q2–Q4 2019	Expansion of network into all prescription drugs with incorporation of communication, education, and early intervention incentive structures
	AI implementation to automate detection of fraud and abuse in the healthcare system--important to prevent patients from being lost in the system after it is too late.
	Integration with Pharmaceutical supply chain to prevent counterfeit drugs from entering the market
	Partnership with payors and healthcare systems to allow discounted payments through patient portal and introduce new value-based incentive structure that promotes early prevention rather than treatment

2020	International expansion. Introduction of value-based and fraud proof prescription system to the UK, Europe, Canada, and Australia.
	Introduction of a secure borderless prescription system to improve access to healthcare and transfer of medical information tied to individual's sovereign identity.
2021	Introduction of affordable platform for e-prescribing in resource constrained developing countries
	Partnership with key healthcare startups in tokenization of medical data so that the patient is the one who profits from the commercial use of their data

References

"Ethereum Project" [software] Available from www.ethereum.org

Opioid Addiction 2016 Facts & Figures. (2017, January 01). Retrieved from:
https://www.asam.org/docs/default-source/advocacy/opioid-addiction-disease-facts-fig
ures.pdf

STAT forecast: Opioids could kill nearly 500,000 Americans in the next decade. (2017, June
27). Retrieved from: https://www.statnews.com/2017/06/27/opioid-deaths-forecast/

Drug Deaths in America Are Rising Faster Than Ever (2017, June 5). Retrieved from:
https://www.nytimes.com/interactive/2017/06/05/upshot/opioid-epidemic-drug-overdose-
deaths-are-rising-faster-than-ever.html

"Guidelines for Prescribing Opioids for Chronic Pain" (2017, August 29). Retrieved from:
https://www.cdc.gov/drugoverdose/pdf/Guidelines_Factsheet-a.pdf